UDOT Annual Bridge Report

April 2014

udot.utah.gov

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LIST OF ACRONYMS

AASHTO	American Association of State Highway and Transportation Officials
AC	Asphaltic Concrete
BHI	Bridge Health Index
CFR	Code of Federal Regulations
CoRe	Commonly Recognized (elements)
FC	Fracture Critical
FO	Functionally Obselete
FT	Feet
FHWA	Federal Highway Administration
MAP-21	Moving Ahead for Progress in the 21st Century Act
NBI	National Bridge Inventory
NBIS	National Bridge Inspection Standards
NHPP	National Highway Performance Program
NHS	National Highway System
SC	Scour Critical
SD	Structurally Deficient
SF	Square Feet
STP	Surface Transportation Program
STRAHNET	Strategic Highway Network
UDOT	Utah Department of Transportation
UW	Underwater

[Insert Introduction Letter from Josh]

Section 1
EXECUTIVE SUMMARY

1.1 INTRODUCTION

The 2014 UDOT Annual Bridge Report summarizes the condition and sufficiency of the state's structure inventory. This inventory includes all bridges, box culverts, and miscellaneous drainage structures tracked by the state's Bridge Management System; most of which are reported annually to the Federal Highway Administration (FHWA) depending on their size and function. Currently, UDOT does not inspect, formally track, or assess structures with spans less than 20 feet, sign structures, or retaining walls.

1.1.1 Structure Inventory

UDOT oversees, operates, and/or maintains 2,950 structures, including state and locally owned public structures as of April 1, 2014. The state has management responsibility (i.e., ownership) of 1,889 structures. Local agencies own a combined 1,061 structures. There are 175 different ownership agencies. State structures are distributed geographically by region. The number of state owned structures within each region is 373, 554, 290, and 673 for Regions 1, 2, 3, and 4, respectively.

The average year built of the inventory is 1981 and 1980 for state and locally owned structures, respectively. There are only a handful of structures built prior to the 1950s that are still in service – 83 state and 128 local. These structures have significantly exceeded their design service life and are expected to be considered for replacement or rehabilitation in the near future.

There are two categories of structures that have significantly more risk – Fracture Critical (FC) and Scour Critical (SC) structures. FC bridges lack load path redundancy and SC bridges are susceptible to scour damage. The state owns 62 FC bridges and 20 SC structures.

Complex and high-cost bridges in Utah require special bridge management consideration. These structures make up a relatively small amount of the overall inventory; however, their asset value is very high. Complex bridges exhibit non-typical construction techniques such as large arches or segmental boxes. High-cost structures are large or complex structures that have significantly higher replacement costs. The state owns 17 complex and 77 high-cost bridges.

1.1.2 Structure Condition

In general, the state's structure inventory is in good condition, particularly when compared to its national counterparts. In 2012, Utah ranked 2nd in the nation based on percentage of Structurally Deficient (SD) bridges (calculated by deck area) and ranked 11th based on percentage of Functionally Obselete (FO) bridges (calculated by deck area). These values contain both state owned and locally owned structures.

SD bridges are not inherently unsafe. An SD bridge, when left open to traffic, typically requires significant maintenance and repair to remain in service and eventual rehabilitation or replacement to address deficiencies. Functional obsolescence is a function of bridge geometrics

in relation to geometrics required by current design standards. Only three state owned structures are load posted.

1.1.3 Structure Programs

The Department has implemented various programs to identify and fund projects to maintain the state's structure inventory in a state of good repair. The following programs and their purposes are:

- Bridge Inspection Program – The Department conducts bi-annual safety inspections according to National Bridge Inspection Standards (NBIS) policy. Results are reported to FHWA annually in April. These inspections have been performed since the national standards program was adopted in 1971. In 2014, UDOT will begin the transition to the recently updated AASHTO elements, which are described in the *AASHTO Manual for Bridge Element Inspection*.

  Utah has approximately 60 state and local structures that require underwater (UW) inspections. These inspections are performed on a maximum five-year cycle. The next inspection cycle will take place in the summer months of 2014.

- The Bridge Replacement/Rehabilitation Program – this is a reactive program that funds structures requiring major structural work, major safety defects, or complete replacement. The program prioritizes these types of structures based on vulnerability (i.e., risk), criticality (i.e., importance), condition, and load rating. This program addresses the worst condition structures in the inventory. All deficient state owned structures are currently funded.

- The Bridge Preservation Program – this is a proactive program aimed at preserving structures by preventing, delaying, or reducing deterioration of bridges and their elements. The primary benefit of this program is that it extends bridge service life and reduces the amount of future costly replacement or rehabilitation.

- Load Rating Program – this program load rates all state and locally owned structures. This program promotes safety of the traveling public, provides accurate data to support and allocate funding, assists in the development of a programmatic permit truck routing system, and more effectively evaluates higher truck load permits.

- Scour Program – this program allocates funding for projects to address structures that are scour critical. These funds are used to identify and remedy scour hazards and minimize the risk associated with bridge failures due to scour. As part of this program, the Department recently finished a project to address bridges with unknown foundations. The Department identified 455 structures and developed plans of action for each structure.

Section 2
STRUCTURE INVENTORY

2.1 INVENTORY BY CATEGORIES

UDOT oversees, operates, and/or maintains 2,925 structures, including state and locally owned public structures as of April 1, 2014. The Department performs periodic NBIS inspections on these structures and also provides recommendations to local municipalities for bridge maintenance, repair, or replacement.

2.1.1 Ownership

The State has management responsibility (i.e., ownership) of 1,889 structures, which comprise 64 percent of the total structure inventory. Local agencies own a combined 1,061 structures, which comprise 36 percent of the total structure inventory. There are 175 different ownership agencies. The categories of structure ownership are shown in Figure 2-1. The Other Agencies includes (1) private toll bridge, (3) Bureau of Reclamation bridges, and (29) private railroad bridges. The types of state and locally owned structures are shown in Table 2-1. The types of state and locally owned structures by facility carried type are shown in

Table **2-2**.

Figure 2-1
Utah Structure Inventory by Owner

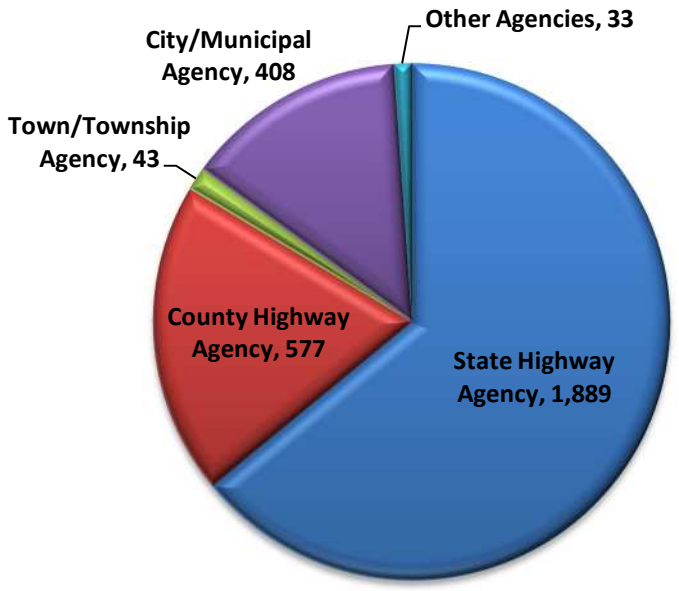


Table 2-1
Utah Structure Inventory by Structure Type

Bridge Type	State	Local
Bridges	1,509	825
Culverts	375	236
Tunnels	4	0
Other*	1	0
Total	1,889	1,061

* 0R 119 is a pipe crossing supported by columns

Table 2-2
Utah Structure Inventory by Facility Carried Type

Bridge Type	State	Local
Highway	1,809	1,035
Railroad	24	29
Pedestrian	34	1
Other	22	0
Total	1,889	1,061

2.1.2 Distribution by Region

UDOT is divided into four regions organized from north to south (with Region 1 in the north and Region 4 in the south). Table 2-3 shows the distribution of structures by region.

Table 2-3
Utah Structures by Region

Owner	Region 1		Region 2		Region 3		Region 4	
	Bridges	Culverts	Bridges	Culverts	Bridges	Culverts	Bridges	Culverts
State	323	50	496	58	237	53[a]	453	220[b]
Local	174	38	209	58	170	30	272	110
Total	497	88	705	115	407	83	725	330

[a] Includes two concrete-lined tunnels
[b] Includes two rock tunnels

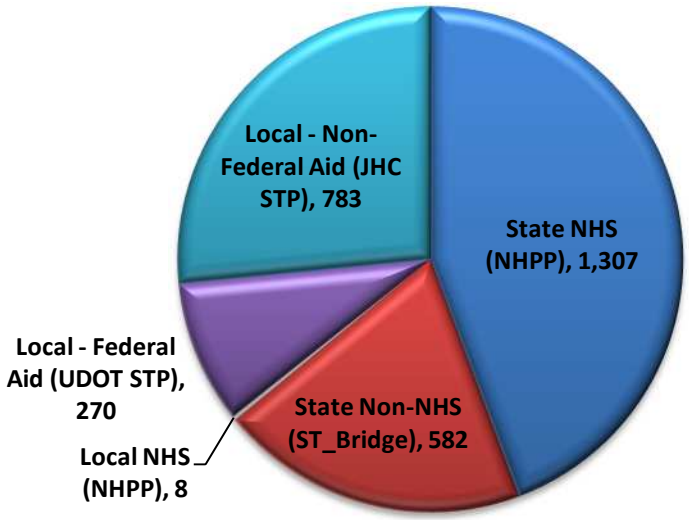
2.1.3 Vehicular Route Types

UDOT identifies public roadway classifications primarily on federal identification and funding type. The National Highway System (NHS) is the principal network of roadways important to the nation's economy, defense, and mobility. The NHS includes interstates (the Eisenhower Interstate System), other principal arterials, the Strategic Highway Network (STRAHNET), major STRAHNET connectors, and intermodal connectors. The U.S. Department of Transportation developed the NHS in cooperation with the states, local officials, and metropolitan planning organizations. Table 2-4 categorizes the state's structure inventory by vehicular route type. Figure 2-2 categorizes the structures on each transportation system.

Table 2-4
Structures by Route Type Carried

Route Description	State	Local
NHS	1,307	8
Non-NHS	582	1,053
Federal-Aid Highways	1,712	278
Non-Federal-Aid Highways	177	783
Interstate Carried	794	0
Interstate Crossed	259	5

Figure 2-2
Structures By System Type and Funding Categories



Funding Definitions:

- NHPP – National Highway Performance Program
- ST_Bridge – State Bridge Fund
- UDOT STP – UDOT Surface Transportation Program
- JHC STP – Joint Highway Committee Surface Transportation Program

2.1.4 Bridge Types

A typical way of categorizing structures is by their primary components in the superstructure, including the girders (or beams) that make up the span of the bridge. The superstructure types are outlined in Table 2-5.

Table 2-5
Utah Structures by Superstructure Type

Superstructure Type		State	Local
Concrete	Normal (Culvert)	306	171
	Normal (Single Span)	126	228
	Normal (Multi-Span)	101	22
	Pre-stressed/Post-Tensioned (Single Span)	583	276
	Pre-stressed/Post-Tensioned (Multi-Span)	173	17
Steel	Steel (Culvert)	68	61
	Steel (Single Span)	225	212
	Steel (Multi-Span)	295	38
Other	Wood or Timber	5	32
	Masonry	1	0
	Aluminum or Iron	2	4
	Tunnels	4	0
	Total	1,889	1,061

Figure 2-3 and Figure 2-4 illustrate state and locally owned structures, respectively, by structure type.

Figure 2-3
State Owned Structures by Structure Type

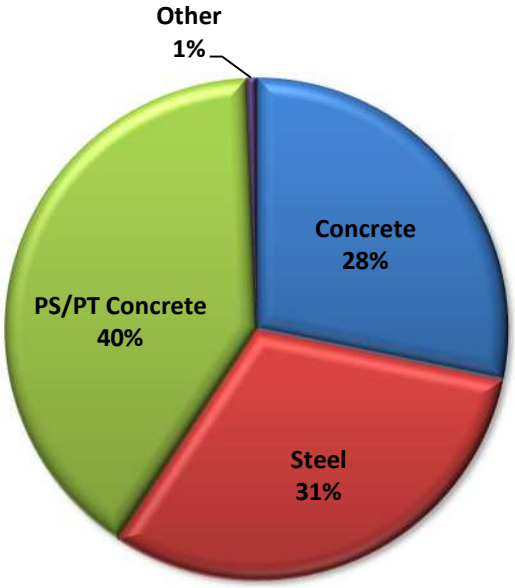
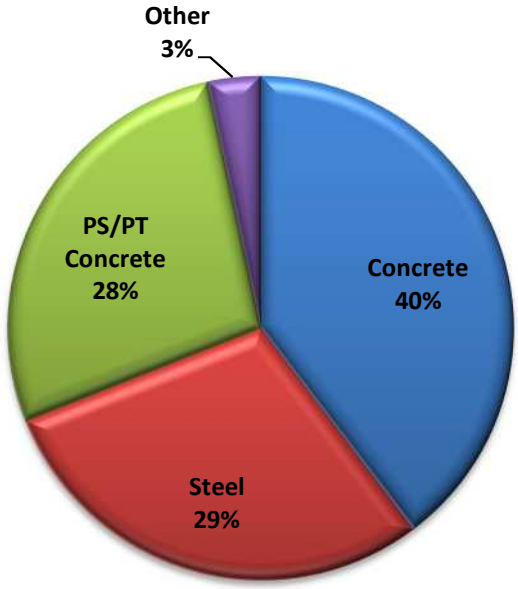


Figure 2-4
Locally Owned Structures by Structure Type



The majority of bridges in the state are short to medium span deck girder bridges. The count of bridges by number of spans is shown in Table 2-6. The count does not contain culverts.

Single span bridges are typically preferred because of their lower initial cost, lower maintenance cost, and higher seismic performance. Multi-span bridges have more foundations, which tend be significantly more expensive due to Utah's geologic conditions.

Table 2-6
Bridges by Number of Spans

Number of Spans	State		Local	
	Count	Percentage	Count	Percentage
1	686	45.5%	684	82.9%
2	254	16.8%	50	6.1%
3	397	26.3%	65	7.9%
4	101	6.7%	14	1.7%
5	34	2.3%	6	0.7%
6	13	0.9%	2	0.2%
7	3	0.2%	3	0.4%
8	7	0.5%	1	0.1%
9	3	0.2%	0	0%
10+	11	0.7%	0	0%

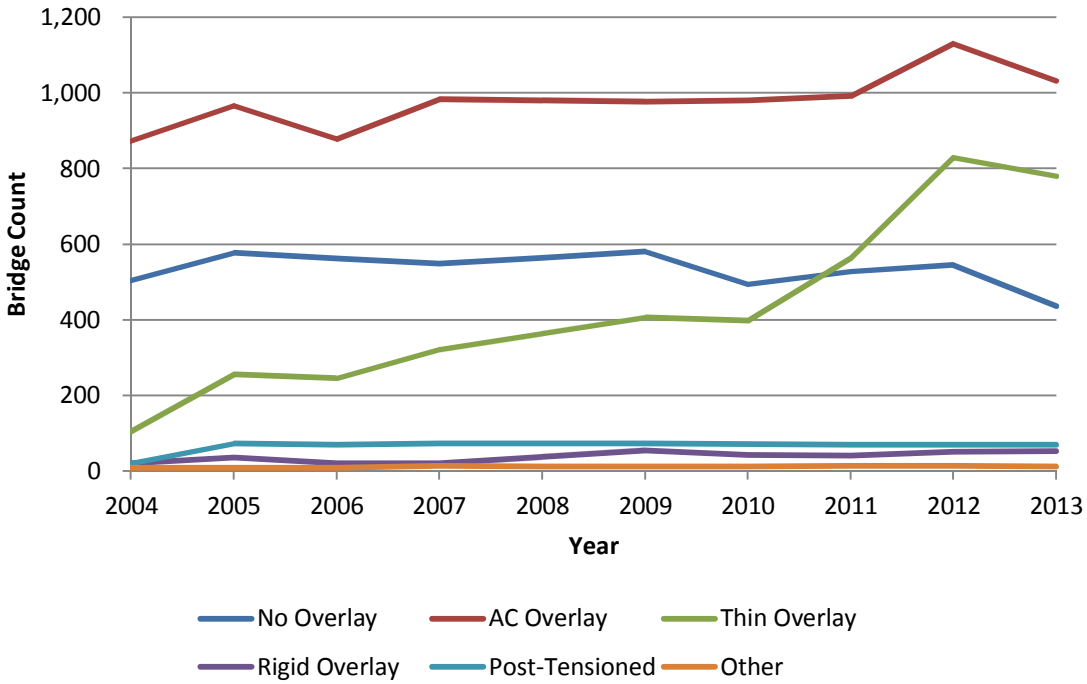
2.1.5 Bridge Deck Types

The deck is the driving surface of a bridge that spans between the main flexural members (i.e., beams, girders) and is the most important component of a bridge's durability and long term protection. Table 2-7 presents state owned deck types. Figure 2-5 shows historical data for state owned deck type counts and area, respectively. The deck types are identified using AASHTO's CoRe bridge inspection elements.

Table 2-7
State Owned Vehicular Bridge Deck Data

Type	Count	Deck Area (SF)
Concrete (No Overlay)	437	4,478,340
Concrete with Asphaltic Concrete (AC) Overlay	1,033	9,560,437
Concrete with Thin Overlay	781	12,471,646
Rigid Overlay	53	1,048,081
Post-Tensioned	70	2,626,231
Other	12	34,540
Total	2,386	30,219,275

Figure 2-5
State Owned Vehicular Deck Type over Time

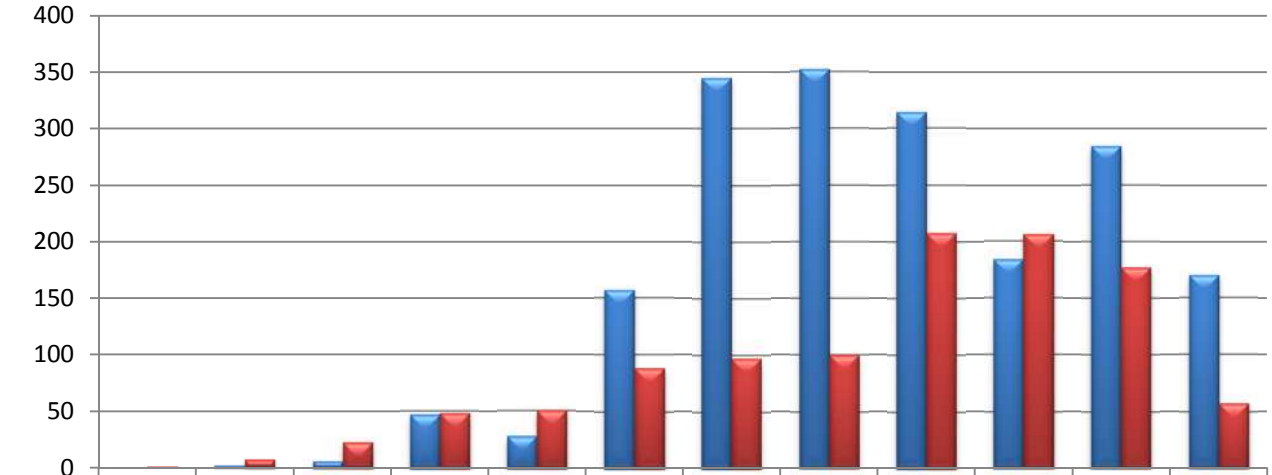


2.2 AGE OF IN-SERVICE STRUCTURES

In the past, UDOT has prioritized the repair or replacement of a bridge by "worse-first" where the worst condition structures had the highest funding priority. Typically, older structures have experienced the most wear and have required replacement. As such, Utah has few structures built prior to the 1950s still in service. This approach has served UDOT well in maintaining a system in a state of good repair. However, with fewer poor condition structures, and the new availability of federal funding for preservation, UDOT is transitioning into a more balanced planning approach that prioritizes funding based on needs and performance. UDOT optimizes funding by employing techniques to preserve structures and extend service life.

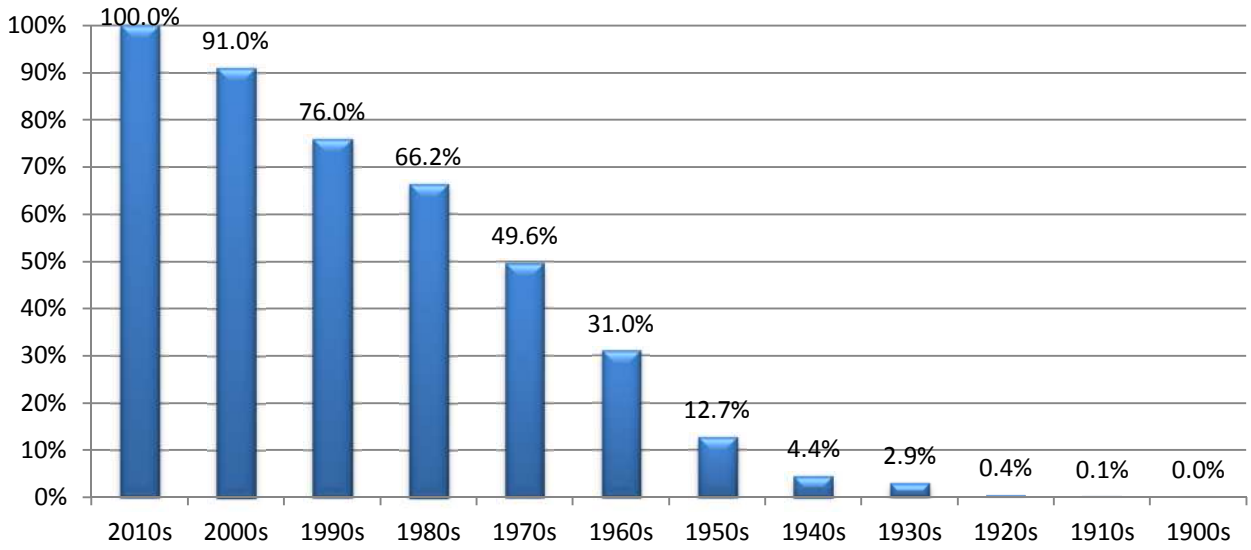
Figure 2-6 graphs the decade in which each structure in the state was built. Figure 2-7 graphs the cumulative age distribution by decade. Stuctures built in the 1950s and earlier were typically designed for a 50-year design service life – this comprises 20.5% of the state owned inventory. The average year built of the inventory is 1981 and 1980 for state and locally owned structures, respectively. Refer to Section 3.1.2 for condition evaluation of the bridges within each decade.

Figure 2-6
Structures by Year Built



	1900s	1910s	1920s	1930s	1940s	1950s	1960s	1970s	1980s	1990s	2000s	2010s
State	0	2	6	47	28	157	345	352	314	184	284	170
Local	1	7	22	48	50	88	97	100	208	206	177	57

Figure 2-7
Cumulative Age Distribution of State Owned Structures by Year Built



2.3 FRACTURE CRITICAL BRIDGES

Fracture Critical (FC) bridges contain steel members in tension, or with a tension element, whose failure would probably cause a portion of or the entire bridge to collapse. The categories of FC bridges in Utah are shown in Table 2-8. The counts do not include railroad or pedestrian bridges.

Table 2-8
Fracture Critical Bridges

Route Description	State	Local
1 or 2 Steel Girder Systems	2	7
Pin and Hanger Details	35	3
Steel Bent Caps	1	0
Steel Trusses	2	14
Suspension or Cable Structures	1	0
Horizontally Curved Girders	7	0
Super/Sub Integral Framing Details	7	0
Multiple FC Details	7	1
Total FC Bridges	62	25

FC bridges require in-depth inspections in which all FC members are inspected within arm's reach or "hands-on."

2.4 SCOUR CRITICAL STRUCTURES

Scour Critical (SC) structures have foundations considered unstable based on evaluated or observed scour (removal of material). Bridges with unknown foundations are difficult to determine scour risk due to a lack of information, such as construction drawings. Table 2-9 shows the number of SC and unknown foundation structures.

Figure 2-8 shows the historical trend of SC structures.

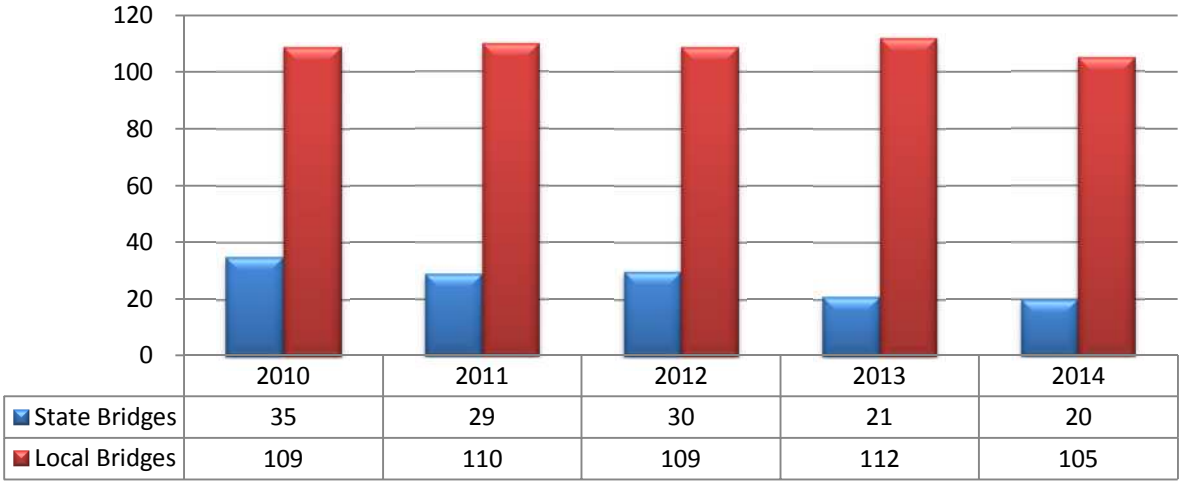
Table 2-9
Scour Critical Foundation Bridges

Route Description	NBIS Field 113	State Owned	Locally Owned
SC – Bridge Failed	0	0	0
SC – Failure Imminent	1	0	0
SC – Extensive Scour	2	0	6
SC – Unstable	3	20	99
Stable, Needs Action	4	31	87

Table 2-9
Scour Critical Foundation Bridges

Route Description	NBIS Field 113	State Owned	Locally Owned
Stable Within Footing	5	113	310
Calculations Not Performed	6	0	3
Countermeasures	7	64	79
Stable Above Footing	8	590	400
On Dry Land	9	10	5
Not Over Waterway	N	1,059	70
Tidal, Low Risk	T	0	0
Unknown Foundation Risk	U	0	1
Not Applicable	P	2	1
Total SC Bridges		20	105

Figure 2-8
SC Bridges by Year



SC structures require specific attention during routine inspections. The footings are probed to determine if any progressive scour is occurring. Changes to the NBIS 113 field are evaluated by bridge and hydraulic engineers based on inspection results.

2.5 COMPLEX AND HIGH-COST BRIDGES

Complex and High-Cost bridges in Utah require special bridge management consideration. These structures make up a relatively small amount of the overall inventory; however, their asset value is very high. It is imperative that these structures maintain a state of good repair and their service lives are maximized.

2.5.1 Complex Bridges

Complex bridges use unique or non-standard structural elements or systems. UDOT defines complex bridges as truss, arch, suspension, cable-stayed, movable, segmental box girder, or hybrid-composite girder bridges that carry vehicular traffic. The amount of bridges in each category is shown in **Error! Reference source not found.**.

Table 2-10
Complex Vehicular Bridges

Route Description	State Owned	Locally Owned
Deck Truss	0	2
Through Truss	2	12
Deck Arch	10	2
Through Arch	3	0
Suspension	0	0
Cable-Stayed	0	0
Movable	0	0
Segmental Box Girder	2	0

2.5.2 High-Cost Bridges

UDOT defines high-cost bridges as meeting one or more of the following:

- Deck area greater than or equal to 40,000 square feet
- Max span length greater than or equal to 300 feet
- Total bridge length greater than or equal to 1,000 feet
- Complex bridges that carry vehicular or railroad traffic (not pedestrian traffic)

High-cost bridges account for 4.1% of the state owned inventory and 2.1% of the locally owned inventory.

Table **2-11** shows the characteristics of high-cost bridges. Some bridges meet multiple criteria. Generally, a high-cost bridge will cost a minimum of $7 million to replace. Large or complex structures will cost significantly more.

Table 2-11
High-Cost Bridges

Route Description	State Owned	Locally Owned
Deck Area ≥ 40,000 SF	58	4
Max Span ≥ 300 FT	14	0
Total Bridge Length ≥ 1,000 FT	25	5
Complex Bridges (Vehicular/Railroad)	17	16
Total High-Cost Bridges	77	22

Section 3
STRUCTURE CONDITION

3.1 CONDITION OF STRUCTURES

The condition assessment of UDOT's inventory is determined by NBIS data and AASHTO's CoRe elements. CoRe element data has been collected in Utah during routine bridge inspections since 2002.

3.1.1 Overall State Owned Bridge Condition

In general, the Utah state structure inventory is in good condition, particularly when compared to its national counterparts. In 2012, Utah ranked 2nd in the nation based on percent of Structurally Deficient (SD) bridges (calculated by deck area) and ranked 11th based on percent of Functionally Obselete (FO) bridges (calculated by deck area). These values contain both state owned and locally owned structures.

SD bridges are not inherently unsafe. An SD bridge, when left open to traffic, typically requires significant maintenance and repair to remain in service and eventual rehabilitation or replacement to address deficiencies. The Department identifies SD bridges for consideration in the Replacement and Rehabilitation Program. Functional obsolescence is a function of the geometrics of the bridge in relation to the geometrics required by current design standards. Functional obsolescence is not a key identifier for the Structures Division to determine funding. These structures are usually identified by the Regions as part of roadway projects due to substandard geometric standards.

The following items quantify the most critical structure deficiency concerns of the state owned inventory:

- SD Structures – 23 (173,698 square feet of deck area)
- FO Structures – 164 (1,292,302 square feet of deck area)
- Load Posted Structures – 3

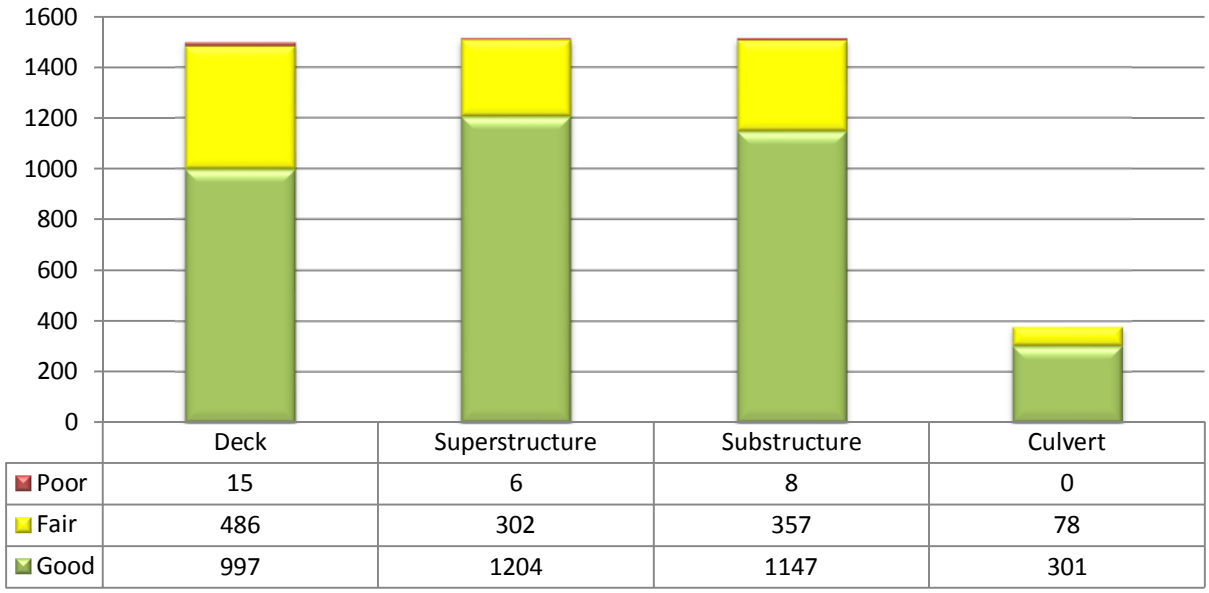
An overall representation of the general structural components of state owned structures are shown in

Figure 3-1. The National Bridge Inventory Standard (NBIS) values for categories are:

- Good – 9-7
- Fair – 6-5
- Poor – 4-1

The number of state owned structures in each NBIS component is shown in Table 3-1.

Figure 3-1
Overall Structure Conditions by NBIS Components



	Deck	Superstructure	Substructure	Culvert
Poor	15	6	8	0
Fair	486	302	357	78
Good	997	1204	1147	301

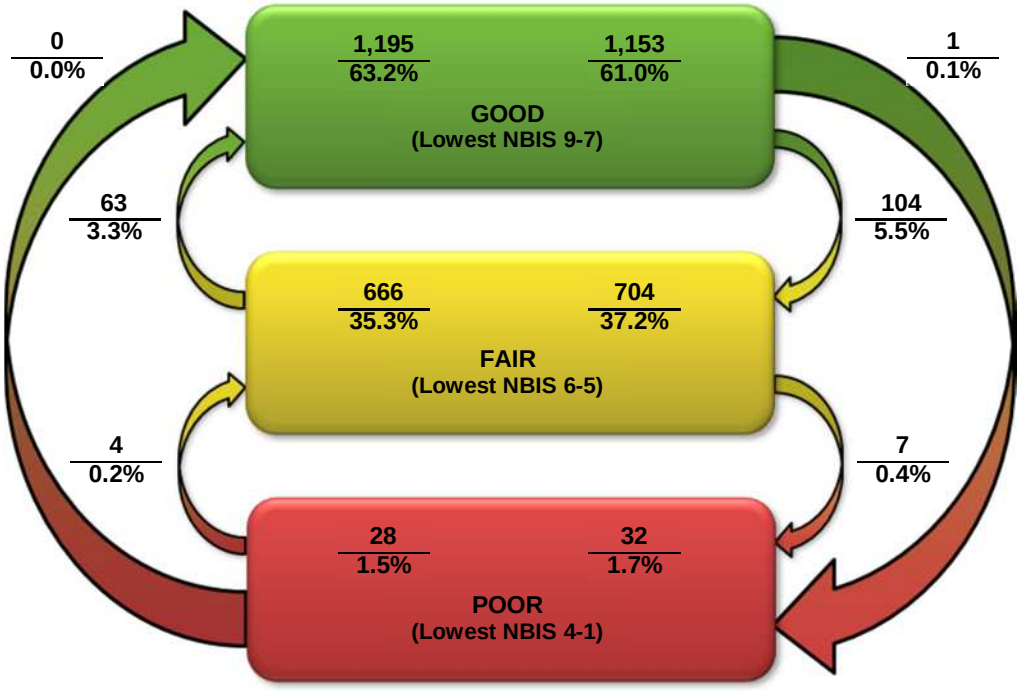
Table 3-1
Number of Structures in each NBIS Components

NBIS Component	9	8	7	6	5	4	3	Average NBIS
Deck	25	160	812	400	86	15	0	6.73
Superstructure	29	462	713	233	69	6	0	7.09
Substructure	26	316	805	296	61	8	0	6.95
Culvert	0	88	213	60	18	0	0	6.98

One way that UDOT defines a structure's overall condition is by taking the lowest of its NBIS component ratings. An overall representation the changes that occurred from 2012 to 2013 on state owned structures are shown in

Figure 3-2.

Figure 3-2
Inspection Cycle 2012 – 2013



Note: The values above are based on a total bridge count of 1,889 state owned bridges.

3.1.2 Bridge Health Index

UDOT is developing its own method for assessing overall bridge condition called the Bridge Health Index (BHI). This method rates the bridge as a whole based on the deterioration of each element using cost to weigh importance. This method is a useful tool in evaluating bridge needs and prioritizing funding.

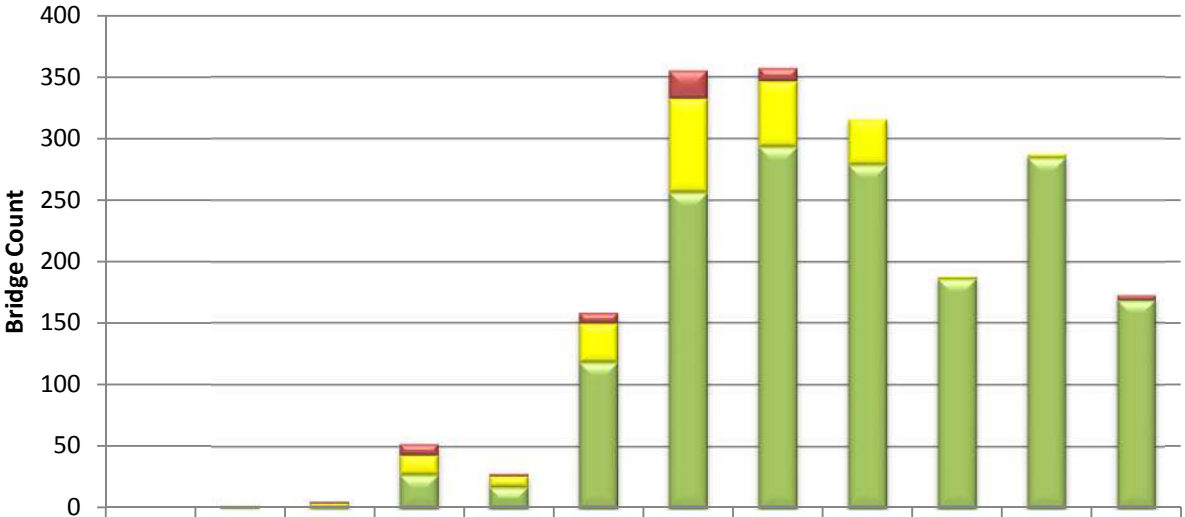
An older method that accomplished similar goals was called the Sufficiency Rating. It was provided by FHWA and was used to qualify for federal funding. The transition to funding under the MAP-21 funding program allows a state to develop their own method of condition evaluation.

UDOT's state owned and locally owned bridges are shown graphically in

Figure 3-3 and Figure 3-4. The BHI categories have been roughly calibrated to the NBI data. The categories are:

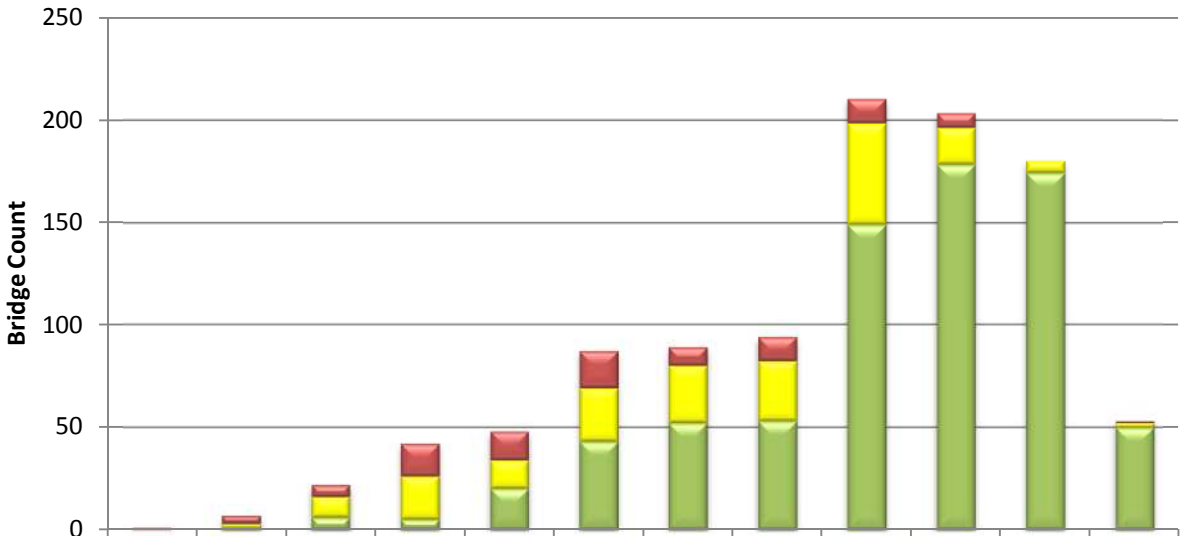
- Good – 100-80
- Fair – 80-60
- Poor – 60-0

Figure 3-3
State Owned Bridge Health Indexes by Decade



	1900s	1910s	1920s	1930s	1940s	1950s	1960s	1970s	1980s	1990s	2000s	2010s
Poor	0	0	2	9	2	9	23	11	0	0	0	4
Fair	0	0	3	16	9	31	76	53	37	2	3	0
Good	0	2	1	27	17	118	256	293	278	186	284	168

Figure 3-4
Locally Owned Bridge Health Indexes by Decade

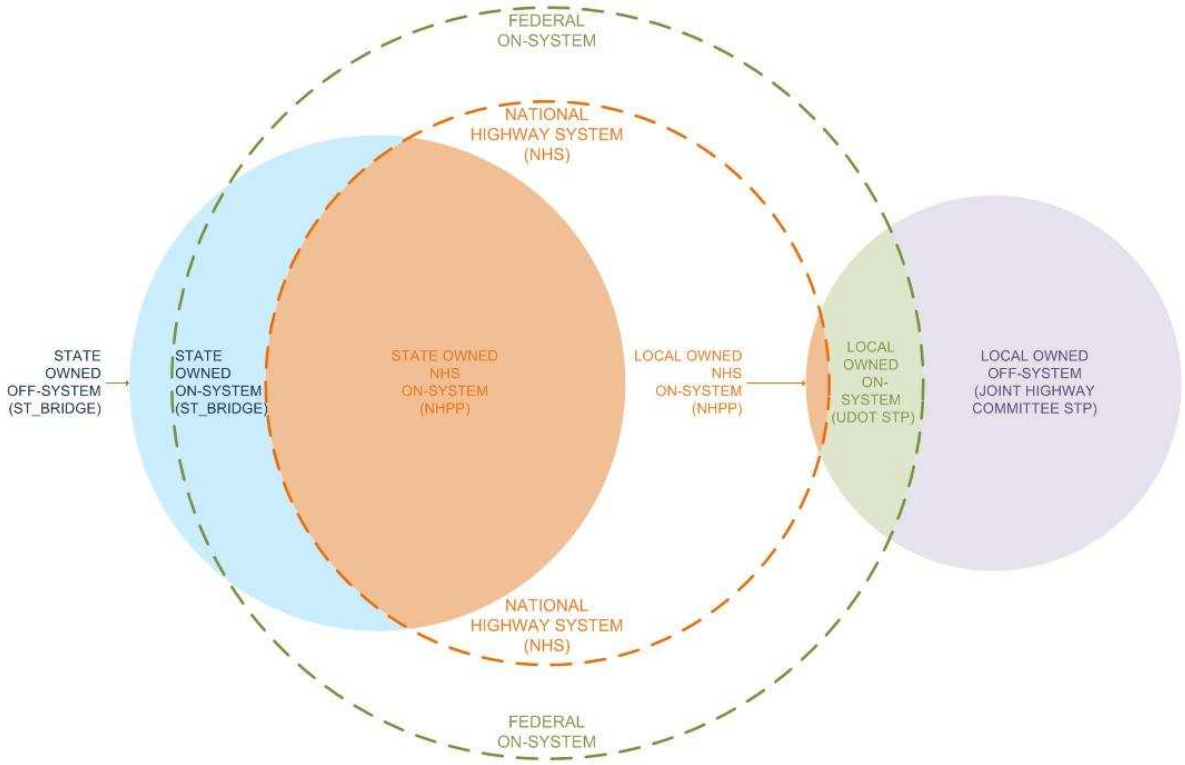


	1900s	1910s	1920s	1930s	1940s	1950s	1960s	1970s	1980s	1990s	2000s	2010s
Poor	1	4	6	16	14	18	9	12	12	7	0	1
Fair	0	2	10	21	14	26	28	29	49	18	6	2
Good	0	1	6	5	20	43	52	53	149	178	174	50

3.2 MAP-21 FUNDING AND PERFORMANCE MEASURES

MAP-21 is the current federal transportation bill which was signed into law in 2012. It consolidated several FHWA funding programs (including the Highway Bridge Program) into the National Highway Performance Program (NHPP) and the Surface Transportation Program (STP). States are required to develop a risk and performance based asset management plan for the NHS to improve or preserve asset condition and system performance. Figure 3-5 displays how state and locally owned bridges are distributed amoung federal on-system and NHS. Refer to 2.1.3 for definitions of the funding types. While some structures may be eligible for multiple funding sources, NHPP funds are used primarily for NHS structures.

Figure 3-5
Diagram of Structures by Ownership and Funding



3.2.1 Structural Deficiency

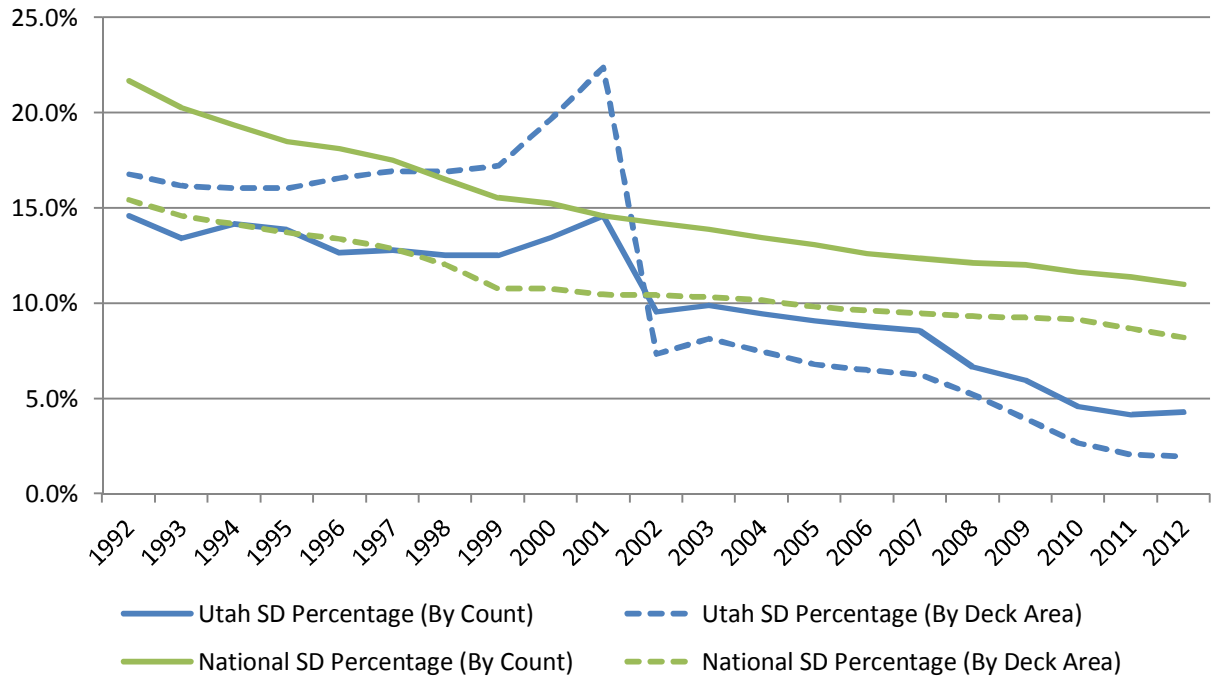
MAP-21 requires a state to devote resources to improve the condition of the NHS until the established minimum is exceeded. The minimum standard for NHS bridges is that no more than 10 percent of the total deck area can be structurally deficient for the three years preceeding. The values of SD bridges for 2013 are shown in Table 3-2. The bridge inventory in Utah is well below this threshold.

Table 3-2
Structurally Deficient Bridges in Utah

	State			Local		
	Deck Area	SD Deck Area	Percentage	Deck Area	SD Deck Area	Percentage
NHS	13,736,991	164,460	1.2%	9,652	0	0%
Non-NHS	3,362,565	56,001	1.7%	2,502,500	78,349	3.1%
Total	17,099,557	220,461	1.3%	2,512,152	78,349	3.1%

Utah's historical trend of SD bridges is shown in Figure 3-6.

Figure 3-6
Percentage of Structurally Deficient Bridges – Utah vs Nation



Section 4
STRUCTURE PROGRAMS

4.1 STRUCTURE INSPECTION PROGRAM

NBIS inspections are performed on each bridge on a two-year (maximum) cycle. The number of inspections performed was 1,534 and 1,675 in calendar years 2012 and 2013, respectively. These inspections include routine and special inspections. Special inspections are performed when a structure's condition warrants more frequent inspections according to UDOT policy.

Underwater (UW) inspections are performed on a maximum five-year cycle. UW inspections are required on bridges that are continuously under four feet of water or more. The are approximately 60 bridges that require UW inspections. These will take place in the summer of 2014.

4.1.1 NBIS 23 Metrics

The Bridge Management Division ensures compliance with FHWA requirements related to managing the existing inventory of bridges. NBIS and 23 Code of Federal Regulations (CFR) §650 discuss several of the requirements. The Bridge Management Manual documents the UDOT policies and procedures (including submission requirements) to comply with the following FHWA requirements:

- Bridge inspection program (e.g., qualifications, inspection frequencies)
- Plan of action for scour critical bridges
- Critical findings
- Quality control/quality assurance
- Bridge inventory (e.g., maintenance of, annual submission to FHWA)
- Load rating

The Bridge Management Division and FHWA hold quarterly meetings to discuss the status on each of the FHWA requirements. The meetings address issues such as scheduled bridge inspections for the next few months. UDOT is currently compliant on all 23 metrics.

In 2010, Congress directed FHWA "to make more significant progress in improving its oversight of bridge conditions and safety." In response, FHWA overhauled the "Metrics for the Oversight of the National Bridge Inspection Program." The publication presents 23 metrics, which address the following topics:

- State DOT organization and record keeping
- Qualifications of NBI personnel
- Bridge inspection frequency and procedures
- Load rating and bridge posting

One fundamental goal of the FHWA metrics is to set minimum requirements for FHWA reviews to promote a data driven, risk based approach to oversight during annual NBIS compliance reviews. The metrics are intended to present:

- Clear and uniform expectations for all states
- Consistent criteria for judging each metric
- Compliance determination based upon the criteria for each metric

4.2 BRIDGE REPLACEMENT/REHABILITATION PROGRAM

The Bridge Replacement/Rehabilitation Program funds structures that require major structural work, major safety defects, or complete replacement. The Rehabilitation and Replacement List (formerly known as the Critical Bridge List) prioritizes these types of structures based on vulnerability (i.e., risk), criticality (i.e., importance), condition, and load rating. This program addresses the worst condition structures in the inventory.

Structures built prior to 2000 were typically designed to meet a service life of 50 years. Structures built prior to 1960 are expected to be nearing the end of their service life. There are 239 state structures that will require consideration for replacement or rehabilitation in the near future. Each decade approximately 400 to 500 bridges will be nearing the end of their service life. These structures will also need to be considered for replacement or rehabilitation. On average, UDOT currently builds 34 new structures and rehabilitates eight existing structures per year, which leaves a projected shortfall of 10 to 20 structures each year. Table 4-1 shows the projects in the 2014 – 2018 Bridge Replacement/Rehabilitation Program.

Table 4-1
FY 2014-2018 Bridge Replacement/Rehabilitation Projects

Yr	Reg	County	Route	Structure Number	Project Location	Concept
2014	1	Davis	I-15	1D 611	I-15 over 2600 S. Interchange in N. Salt Lake	Deck Replacement
				3D 611		Deck Replacement
				1D 615	I-15 over 500 S. Interchange in Bountiful	Deck Replacement
				3D 615		Deck Replacement
				1D 620	I-15 over 1500 S. in Woods Cross	Deck Replacement
				3D 620		Deck Replacement
	2	Salt Lake	SR-270	2C 402	SR-270; 900 S. Connector	Major Rehabilitation
				2C 400		Major Rehabilitation
				4C 400		Major Rehabilitation
				0C 401		Major Rehabilitation
				4C 402		Major Rehabilitation
	2	Summit	I-80	4C 325	I-80; Silver Creek to Wanship	Bridge Replacement
	2	Summit	I-80	0C 433	Judd Lane and Hobson Lane over I-80, near Wanship	Deck Replacement
				0C 434		Deck Replacement

Table 4-1
FY 2014-2018 Bridge Replacement/Rehabilitation Projects

Yr	Reg	County	Route	Structure Number	Project Location	Concept
2015	1	Davis	I-15	1D 611	I-15 over 2600 S. Interchange in N. Salt Lake	Deck Replacement
				3D 611		Deck Replacement
				1D 615	I-15 over 500 S. Interchange in Bountiful	Deck Replacement
				3D 615		Deck Replacement
				1D 620	I-15 over 1500 S. in Woods Cross	Deck Replacement
				3D 620		Deck Replacement
	4	Sanpete	Local	039004F	Clarion Road over Sevier River, west of Centerfield	Bridge Replacement
2016	2	Salt Lake	SR-186 & I-80	0F 52	I-80; 1700 E. to East Canyon	Substructure Repairs, Deck Replcmnt
				3C 423		Repaint Girders, Deck Replacement
				3F 53		Substructure Repairs
				2C 421		Repaint Girders, Substructure Repairs
				0C 422		Repaint Girders, Substructure Repairs, and Widen Bridge
				4C 424		Substructure Repairs
				0F 49		Membrane and Overlay, Substructure Repairs
				0C 562		Repaint Girders
				0C 574		Repaint Girders
				0C 575		Repaint Girders, Substructure Repairs
2017	2	Salt Lake	US-89	1D 672	US-89 (Beck Street); Northbound Ramp to I-15	Major Rehabilitation
	1	Davis	I-15	1C 302	I-15 SB ramp to US-89 SB	Deck Replacement and Repainting
	3	Utah	SR-75	0C 454	SR-75 over UPRR, Springville	Deck Replacement and Major Rehabilitation
	1	Box Elder	SR-240	0F 24	SR-240 over I-15, Honeyville Interchange	Bridge Replacement
2018	1	Box Elder	SR-102	0D 820	SR-102 over West Canal, South of Thatcher	Bridge Replacement
	3	Duchesne	SR-311	0C 72	SR-311 over Strawberry River, North of Duchesne	Bridge Replacement

Table 4-1
FY 2014-2018 Bridge Replacement/Rehabilitation Projects

Yr	Reg	County	Route	Structure Number	Project Location	Concept
2018 (Cont.)	3	Wasatch	SR-113	D 470	SR-113 over Provo River, near Midway	Substructure Rehabilitation
	2	Summit	I-84	2C 475	I-84 EB to I-80 EB, Echo Interchange	Deck Replacement and Major Rehabilitation
	1	Weber	SR-39	0D 634	SR-39, Ogden Canyon between Ogden and Pineview Reservoir	Bridge Replacement
				0F 381		Rehabilitation
				0F 598		Rehabilitation
	2	Salt Lake	I-15	1F 655	R2; I-15 between 1000 S. & 2100 S.	Polyester Concrete Overlay
				3F 655		
				1F 636		
				3F 636		
				1F 637		
				3F 637		
				1F 633		
				3F 633		
				1F 630		
				3F 630		
	4	Garfield	Local	017045V	R4; County Roads over Alvey and Twenty Mile Washes	Culvert Replacement
			Local	017054V		
	1	Box Elder	Local	003025D	6800 W. Street in Box Elder County over Corinne Canal	Bridge Replacement

4.3 BRIDGE PRESERVATION PROGRAM

The Bridge Preservation Program is a proactive program aimed at preserving structures in a state of good repair. Bridge preservation is defined as actions or strategies that prevent, delay, or reduce deterioration of bridges or bridge elements, restore the function of existing bridge elements, keep bridges in good condition, and extend their life. Preservation actions may be preventive or condition driven. The Bridge Preservation Program implements activities that aid in extending the life of a bridge for relatively limited cost. Funding can be used for stand-alone projects or bridge work combined with established Region pavement projects. Table 4-2 shows the projects in the 2014 and 2015 Bridge Preservation Program.

Table 4-2
FY 2014-2017 Bridge Preservation Projects

Yr	Reg	County	Route	Structure Number	Project Location	Concept
2014	2	Salt Lake	SR-68	0F 33	SR-68; N. Temple to End of PCCP	Healer/Sealer, Seal Parapet, SubStr Repair
				0F 34		Healer/Sealer, Seal Parapet, SubStr Repair
				0F 35		Healer/Sealer, Seal Parapet, SubStr Repair
	2	Salt Lake	SR-68	0D 480	SR-68; 2100 S to California Ave.	AS Overlay, Membrane, Pothole Patch, Beam Repair
	4	Kane	US-89	0C 337	US-89; Coral Pink Sand Dunes to Jct. SR-9	AS Overlay, Joint Closure, Beam Repainting
	4	Kane	US-89	0C 298	US-89; Arizona Line to Buck Tank Draw	Remove & replace HMA & membrane. 6.5" @ CL & 2" @ curb
	2	Tooele	I-80	2F 361	I-80; MP 0-10	Pothole patching, waterproofing membrane, and overlay
				4F 361		Pothole patching, waterproofing membrane, and overlay
				4C 591		Pothole patching, waterproofing membrane, and overlay
2015	1	Davis	SR-67	1F 703	SR-67; Legacy Parkway	Polymer Overlay & Pothole Patching, Parapet Surface Repair
	1	Davis	SR-67	3F 703		Polymer Overlay & Pothole Patching, Parapet Surface Repair
	1	Davis	SR-67	1F 644		Polymer Overlay & Pothole Patching, Parapet Surface Repair
	1	Davis	SR-67	3F 644		Polymer Overlay & Pothole Patching, Parapet Surface Repair
	2	Salt Lake	I-215	3C 857		Polymer Overlay & Pothole Patching, Parapet Surface Repair
	2	Davis	I-215	3F 701		Polymer Overlay & Pothole Patching, Parapet Surface Repair
	2	Salt Lake	I-215	1F 747		Polymer Overlay & Pothole Patching, Parapet Surface Repair

Table 4-2
FY 2014-2017 Bridge Preservation Projects

Yr	Reg	County	Route	Structure Number	Project Location	Concept
2015 (Cont.)	1	Davis	Local	0F 718	SR-67; Legacy Parkway (Cont.)	Polymer Overlay, Parapet Surface & Sidewalk Repair
	1	Davis	Local	0F 717		Polymer Overlay, Parapet Surface & Sidewalk Repair
	1	Davis	SR-67	1F 667		Polymer Overlay, Parapet Surface Repair, Concrete Coating
	1	Davis	SR-67	3F 667		Polymer Overlay, Parapet Surface Repair, Concrete Coating
	4	Grand	I-70	2D 549	I-70; Cisco to Westwater	Remove & replace Asphalt Overlay/Membrane
				4F 286		Remove & replace Asphalt Overlay/Membrane
				2F 186		Remove & replace Asphalt Overlay/Membrane
				4F 186		Remove & replace Asphalt Overlay/Membrane
	4	Grand	SR-279	0V 2059	SR-279; Potash Plant Road, MP 0 - 4.1	Scour Repair - Cutoff wall replacement
				0V 2058		Scour Repair - Cutoff wall repair
				0V 1720		Scour Repair - Riprap placement

4.3.1 Painted Steel Protection Systems

UDOT is in the process of developing a program to address the protective paint system on steel superstructures. Table **4-3**Table 4-3 shows the current quantities of painted steel elements in each condition state.

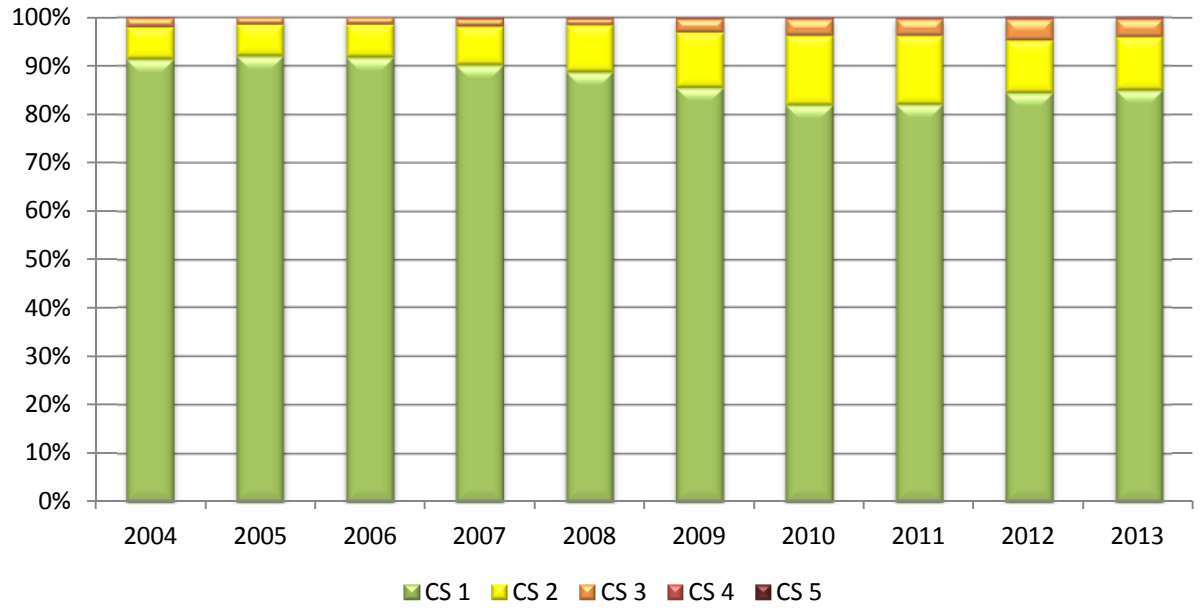
Table 4-3
Painted Steel Superstructure Condition Summary

Description	Quantity (FT)	Percent	Repair Action
Condition State 1	1,342,092	84.9%	None

Description	Quantity (FT)	Percent	Repair Action
Condition State 2	174,041	11.0%	Spot paint trouble areas such as beam ends
Condition State 3	58,826	3.7%	Repaint
Condition State 4	5,331	0.3%	Repaint
Condition State 5	79	0.005%	Repaint
Total	1,580,369	100%	

Utah's historical trend of painted steel superstructure elements is shown in Figure 4-1.

Figure 4-1
Painted Steel Superstructure by Year and Condition State



4.3.2 Concrete Deck Protection

UDOT has been applying protective overlays to bridge decks for many years. Initially, asphalt overlays were applied mostly due to asphalt pavement adjacent to the bridge and to address rideablility issues, as opposed to addressing bridge protection.

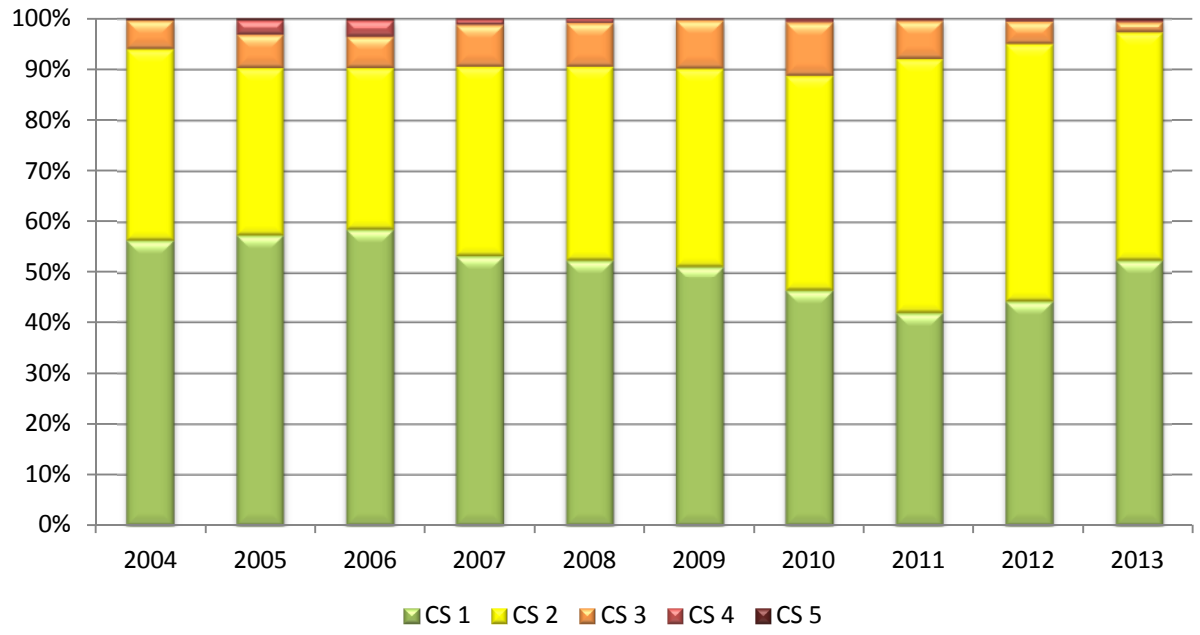
Recent developments in asset management strategies have led to improved performance and extended service life in bridge decks. One such strategy is to add thin-bonded polymer overlays to existing bare concrete bridge decks. Another strategy is to apply a thin, low-permeability rigid overlay such as polyester concrete. Table 4-4 provides the current information on bridges without any overlay protection.

Table 4-4
Bare Concrete Deck Elements Summary

Description	Quantity (SF)	Percent	Repair Action
Condition State 1	743,424	52.6%	Apply a protective overlay
Condition State 2	632,951	44.8%	Structral pothole patch and apply a protective overlay
Condition State 3	27,199	1.9%	Structral pothole patch and apply a protective overlay
Condition State 4	5,416	0.4%	Replace upper portion of deck and apply a protective overlay
Condition State 5	5,416	0.4%	Replace deck entirely or upper portion and apply a protective overlay
Total	1,414,406	100%	

Utah's historical trend of bare concrete deck elements is shown in Figure 4-2.

Figure 4-2
Bare Concrete Decks by Year and Condition State Percentages



4.4 LOAD RATING PROGRAM

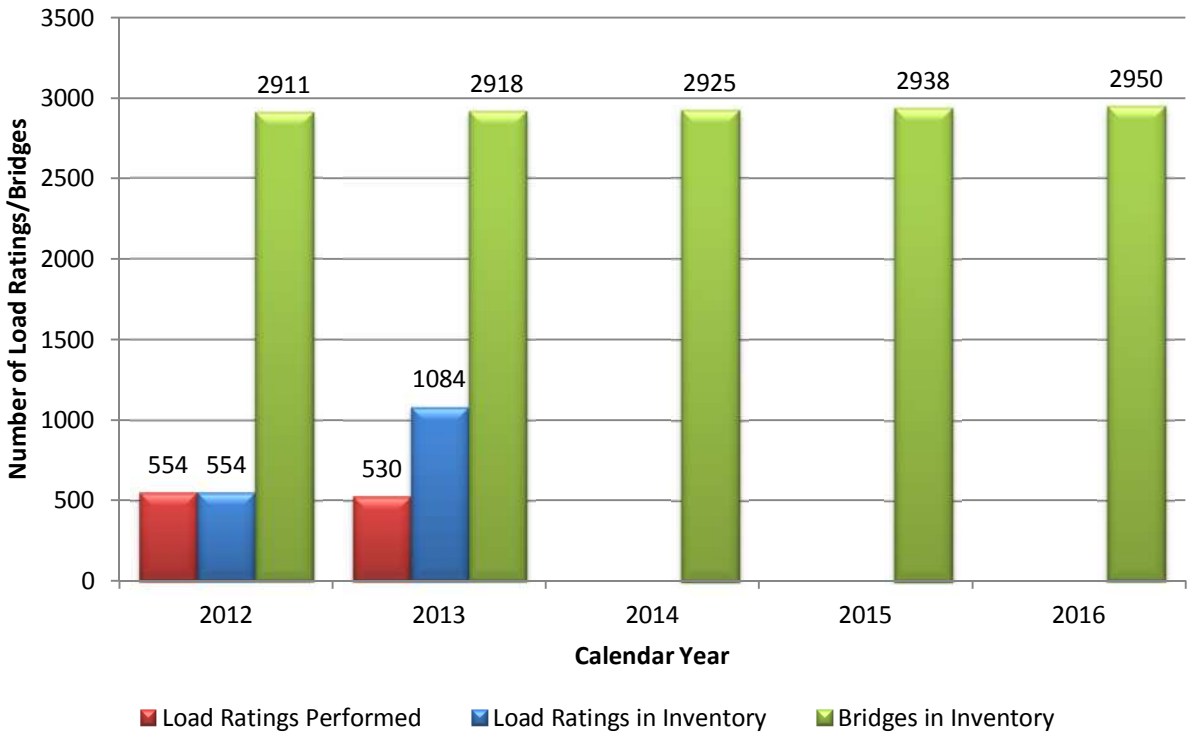
UDOT is currently in its third year of a four-year (fiscal year) program to load rate all state and locally owned structures. This program promotes safety of the traveling public, provides accurate data to support and allocate funding, assists in the development of a programmatic

permit truck routing system, and more effectively evaluates higher truck load permits. Table 4-5 shows all of the state owned structures that are load posted. Figure 4-3 shows the current progress. The total structure count is based on public (non-private) structures.

Table 4-5
State Owned Structures that are Load Posted

Bridge ID	Location	Facility Carried	Feature Intersected	Posting
0A 385	1 mile east of Ivie Crek Interchange	SR-76	Unnamed Wash	Tandem Group 34,000 lb
0A 387	1.5 miles west of Fremont Junction Interchange	SR-72	Post Hollow Wash	Tandem Group 34,000 lb
0A 446	North of Mayfield	SR-137	Twelve Mile Wash	Tandem Group 34,000 lb

Figure 4-3
Load Rating Program Progress



4.5 SCOUR PROGRAM

The goal of this program is to allocate funding for projects to address structures that are scour critical. These funds are spent to identify and remedy scour hazards to minimize the risk associated with bridge failures due to scour. This work will reduce future maintenance costs

associated with scour. The established program was recently completed and has been incorporated into the bridge preservation program.

4.5.1 Unknown Foundation Program

UDOT recently finished its program to to address bridges with unknown foundations as required by the Federal Highway Administration Memorandum for Technical Guidance for Bridges over Waterways with Unknown Foundations dated January 9, 2008 which states November 2010 as the target date for eliminating the number of bridges with unknown foundations from a state's inventory. UDOT identified 455 structures and developed plans of action for each structure. Roll out of the final plans of action to all local owners is in progress.